UNITED STATES PATENT APPLICATION

Alignment Weight for Floating Pin Field Design

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ATTORNEY DOCKET 884.103US3
Intel Docket P6814C

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This application is a continuation of U.S. Patent Application Serial No. 09/754,714, filed January 4, 2001, which is a divisional of U.S. Patent Application Serial No. 09/288,486, filed April 8, 1999, which is now U.S. Patent No. 6,206,272, which are incorporated herein by reference.

Technical Field of the Invention

Embodiments described herein relate generally to the field of electronic circuits and, in particular, to an alignment weight for an electronic circuit with a floating pin field design.

Background

Integrated circuits are a common part of modern electronic equipment. Integrated circuits typically include a large number of transistors and other circuit elements that are interconnected on a common semiconductor chip or die. Typically, integrated circuits are packaged independently and interconnected on a printed circuit board for installation in an electronic system, such as a computer.

A printed circuit board can be connected to an electronic system in a number of ways. For example, a printed circuit board can include a "floating pin field" on one side of the printed circuit board. The floating pin field includes a number of pins that are held in a fixed spatial relation by a pin field carrier through which the pins pass. The pins are electrically connected to circuit elements on the printed circuit board. A floating pin field design may be used, for example, with a printed circuit board containing an upgraded processor for a computer.

When a floating pin field design is used, the printed circuit board may be connected to a system through a socket such as a socket located on a mother board of a computer system. The socket typically includes a number of receptacles that are placed around a perimeter of the socket. The receptacles receive the pins of the floating pin field.

One problem with printed circuit boards that use a floating pin field design may arise when pins are soldered to the bottom of the printed circuit board. Generally, the pins are held in place with a pin field carrier. The printed circuit board is patterned with solder paste at the locations where the pins are to connect to

the printed circuit board. The pins and the pin field carrier are placed on the board and the solder undergoes a reflow process. Unfortunately, sometimes not all of the solder joints created with this reflow process provide acceptable connection between the pin and the circuit elements on the printed circuit board. So-called "solder bridges"-- solder material that extends over a significant distance between a pin and the printed circuit board -- can be formed, for example, when a pin moves away from the printed circuit board during the reflow process. These solder bridges provide a poor, brittle mechanical connection for the pin and can lead to open solder joints during use. Furthermore, when an open solder joint is detected after production, the part is typically thrown away since rework of the open solder joints is overly burdensome. This can result in a significant waste of resources when fabricating electronic modules using floating pin fields.

For the reasons stated above, and for other reasons stated below which will become apparent to those skilled in the art upon reading and understanding the present specification, there is a need in the art for a more reliable technique for producing acceptable solder joints in an electronic module using a floating pin field design.

Summary

The above mentioned problems with electronic modules using a floating pin field design and other problems are addressed by the various embodiments disclosed, as will be understood by reading and studying the following specification. An alignment weight is described that may be used to hold the pins in place during a reflow process.

In an embodiment, an alignment weight is provided. The alignment weight includes a body of material having first and second opposing surfaces. A number of depressions are formed in the first surface. The depressions receive pins of a floating pin field when placed on a floating pin field during connection of the floating pin field to a printed circuit board.

Brief Description of the Drawings

Figure 1 is a perspective view of an illustrative embodiment of an alignment weight according to the teachings of various embodiments.

Figure 2 is a bottom view of the alignment weight of Figure 1.

Figure 3 is a cross-sectional view of a portion of an electronic module during production with an alignment weight in place according to various embodiments.

Figure 4 is a perspective view of an electronic system module with a floating pin field constructed using the alignment weight according to various embodiments.

Detailed Description

The following detailed description refers to the accompanying drawings which form a part of the specification. The drawings show, and the detailed description describes, specific illustrative embodiments. These embodiments are described in sufficient detail to enable those skilled in the art to practice the teachings disclosed herein. Other embodiments may be used and logical, mechanical and electrical changes may be made without departing from the scope of the disclosure. The following detailed description is, therefore, not to be taken in a limiting sense.

Figure 1 is a perspective view of an alignment weight indicated generally at 100 and constructed according to the teachings of various embodiments. Alignment weight 100 is used in a process for connecting pins of a floating pin field to a printed circuit board. Specifically, alignment weight 100 is designed to provide a downward force that helps to secure pins in place during a solder reflow process and to maintain the pins in a substantially straight-up alignment. Advantageously, alignment weight 100 also maintains the ends of the pins of the floating pin field substantially in the same plane.

Alignment weight 100 is formed from a material that can withstand the heat of a solder reflow process without significant warping. Further, the material has sufficient weight to provide downward force on the pins to assure the creation of an acceptable solder joint. For example, in one embodiment, alignment weight 100 is formed from Ultem® PolyEtherImide material, e.g., Ultem® 2300, commercially available from Ensiger Corporation. Ultem® PolyEtherImide is an amber transparent high performance polymer which combines high strength and rigidity at elevated temperatures with long term heat resistance. Other appropriate materials can be used to produce the body of alignment weight 100.

Alignment weight 100 includes first and second opposing surfaces 104 and 106, respectively. Surface 106 includes a number of depressions 108. Depressions 108 are disposed in surface 106 in positions that correspond to the locations of pins in a floating pin field to be used with alignment weight 100. In one embodiment, depressions 108 are disposed in rows around the perimeter of surface 106 as shown in Figures 1 and 2. However, it is understood that depressions 108 can be disposed

at other locations on surface 106 so as to accommodate the layout of other floating pin field designs.

The size of depressions 108 may be selected to assure proper vertical alignment of the pins of the floating pin field. For example, when the pins have a diameter of approximately 0.01 ± 0.001 inches, depressions 108 may be formed with an outer diameter at surface 106 of about 0.065 inches with an interior angle of 82 degrees and an inner diameter of about 0.055 inches.

Alignment weight 100 further includes holes 110 that extend through a thickness of alignment weight 100 in center region 107. Holes 110 allow heat to flow through alignment weight 100 toward a printed circuit board located below alignment weight 100 during a reflow process. This allows elements other than pins to be soldered beneath the alignment weight when the pins are soldered in place.

In some embodiments, holes 110 are laid out in an array in center region 107. However, it is understood that holes 110 can be located at other positions in alignment weight 100. Further, holes 110 are shown as cylindrical passages through alignment weight 100. Holes 110 can, however, have different sizes and shapes and are not limited to the embodiment shown. In some embodiments, the holes 110 can be omitted when only pins are soldered during a reflow process and no other elements are placed on printed circuit board 304 beneath alignment weight 100.

Figure 3 is a cross-sectional view of a portion of an electronic module 300 during production with alignment weight 100 in place according to various embodiments. Alignment weight 100 may be used to assure proper contact between pins 302 and printed circuit board 304 at solder contacts 306. Advantagously, alignment weight 100 can be used to maintain the ends 314 of pins 302 in substantially the same plane. This reduces the likelihood that solder bridges will form at the base of any of pins 302.

The pins 302 may be held in a fixed alignment by the field carrier 308, which may be formed from flame retardant 4 (FR4) material with holes for receiving pins 302. Field carrier 308 may hold the pins 302 in a position that is substantially normal to surface 307 of field carrier 308. The floating pin field 310 may comprise the pins 302 and the field carrier 308.

The floating pin field 310 may be placed in contact with screen printed solder paste on surface 312 of printed circuit board 304 at connection points for pins 302. With the floating pin field 310 in place, alignment weight 100 may be placed over the ends 314 of the pins 302 such that depressions 108 align with the ends 314 of the pins 302. Electronic module 300 along with alignment weight 100 may

undergo a solder reflow process to form the contacts 306. The alignment weight 100 may then be removed.

As shown in Figure 4, additional circuit components 400 can be coupled to the printed circuit board 304 using, for example, surface mount technology. For example, an upgraded microprocessor can be coupled to the printed circuit board for insertion into a computer system on the printed circuit board 304.

Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement which is calculated to achieve the same purpose may be substituted for the specific embodiments shown. Such applications are intended to cover any adaptations or variations of the various embodiments. For example, the alignment weight can be used with floating pin fields for electronic modules other than a processor upgrade. Further, the location, depth, diameter, and interior angle of the depressions 108 can be varied as necessary for a particular pin field. Further, the alignment weight 100 can be formed without holes 110. Further, circuit components 400 can be coupled to both sides of the printed circuit board 304. Other materials that are resistant to warping at elevated temperatures and that provide sufficient weight to aid in improving the solder bonds can be used for the alignment weight 100 in place of the Ultem® PolyEtherImide material described above. Other bonding materials can be used in place of solder to connect the pins 302 to the printed circuit board 304.

This detailed description is not to be taken in a limiting sense, and the scope of various embodiments is defined only by the appended claims, along with the full range of equivalents to which such claims are entitled. Thus, although specific embodiments have been illustrated and described herein, it should be appreciated that any arrangement calculated to achieve the same purpose may be substituted for the specific embodiments shown. This disclosure is intended to cover any and all adaptations or variations of various embodiments of the invention. Combinations of the above embodiments, and other embodiments not specifically described herein, will be apparent to those of skill in the art upon reviewing the above description.

The Abstract of the Disclosure is provided to comply with 37 C.F.R. §1.72(b), requiring an abstract that will allow the reader to quickly ascertain the nature of the technical disclosure. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims. In addition, in the foregoing detailed description, it can be seen that various features are grouped together in a single embodiment for the purpose of streamlining the disclosure. This method of disclosure is not to be interpreted as reflecting an intention that the

claimed embodiments of the invention require more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive subject matter lies in less than all features of a single disclosed embodiment. Thus the following claims are hereby incorporated into the detailed description, with each claim standing on its own as a separate preferred embodiment.